

**MADONNA UNIVERSITY NIGERIA**

**MICROBIOLOGY  
STUDENTS' HANDBOOK**

**REVISED EDITION- 2016/2017 SESSION**

### **BRIEF HISTORY OF THE DEPARTMENT**

The Department of Microbiology started as a unit under the Department of science, Faculty of Engineering, Science and Technology in May 1999. The Department was coordinated by Mr Onokuba John. In 2002, the Department of Biological sciences was created under the same faculty, with microbiology as the only programme. Mr Yah Suh Clearance was appointed to Head the Microbiology Programme. During the first National University Commission's accreditation visit in April, 2004, the institution was advised to create a separate faculty of science from the Faculty of Engineering.

In July 2004, the University Senate approved the creation of some new faculties as recommended by NUC accreditation panelist. Among these was the Faculty of Science, with Prof. N. C. Azubuike as the Dean. Senate approval for the Faculty of science came up at the same time the Faculty was transferred from Okija campus to Elele campus. Elele campus then, already housing the Faculties of Medicine, Pharmacy and Health Sciences. Four units were raised to full departmental status. These were; Departments of microbiology, Biochemistry, Industrial chemistry and Computer sciences. In November 2004, Microbiology Department and others under the Faculty of science moved to Elele campus.

In July 2005, Mr Yah Clearance, the then acting Head of Microbiology Department resigned and picked up appointment with Igbenedion University Okada, Benin. Mr Agwung Fobellah Dominic was appointed as acting Head of Microbiology Department in August, 2005. In November, 2006 Microbiology Department faced NUC re-accreditation exercise. This time the Department was granted full accreditation status, being the first of its type in the Faculty of Science of Madonna University Elele campus. Microbiology department of Madonna University Elele sent forth her first batch of graduates in November 2003. Prof. A. J. Njoku was appointed second Dean, Faculty of Science in March, 2007. In September 2007, Microbiology staff resolved to embark on Annual Lecture series to enlighten the campus community on important microbiological issues affecting the world. This Lecture series was plan to be coinciding with the celebration of World HIV day, on first December 2007. Last December first 2011 was the fifth annual staff seminar series/ world HIV day.

Staff of microbiology Department have been very regular and consistent in their participation at the annual conference / Association general meeting of the Nigerian Society for Microbiology (NSM). It has been our policy in the Department that each year we sponsor five students to present their research project findings at the NSM annual conference.

Governance of our Department adopts an integrated approach in which each staff is assigned to a duty as a coordinator or officer. Main duties in the Department are carried out by these coordinators/ officers. These officers in turn report to the Head of Department who supervises their duties. Departmental meetings are held on second Tuesday of each month from 9:00

a.m. During monthly meetings issues affecting or likely to affect the wellbeing of microbiology staff and students as well as the teaching of the course are raised, deliberated, debated and finally resolved in a cordial way that will enhance the sustainability of our role as staff and relationship with students and the administration.

Presently we have a total of 14 staff in all areas of specialization in microbiology. Our staff uses diverse and systematic pedagogic approaches in the delivery of lectures and dissemination of information through tutorials to the satisfaction of even people with learning disabilities.

### **PHILOSOPHY OF THE PROGRAMME**

The philosophy of microbiology programme in Madonna University is to produce refined Nigerians who are decent in morals and education, while seeking to expose them to all facets of Microbiology with the purpose of self-realization and a sense of the need to contribute to National development. Problem endorsement in the programme is to be found in the concrete objective of the Nigerian challenging milieu of entrepreneurship. Training of microbiology students in Madonna University give the students a broad exposure to the theory and practice of microbiology and particularly to educate them in the various applications of microbiology in medicine, industry, agriculture and other fields.

### **OBJECTIVES OF THE PROGRAMME**

- (a) Training of microbiology students in Madonna University, offers them an excellent education in the biology of microorganisms,(bacteria, fungi, protozoa, and viruses). Through learning about the biology of these microorganisms, students more fully understand the pivotal position they occupy in establishing and maintaining our biosphere, their effects on human, animal, and plant life, and how the biological properties of certain microbes are exploited for certain life rationale. Microorganisms are important in drinking water, wastewater and sewage treatment, production and spoilage of foods, production of antibiotics, bioremediation of toxic compounds, and genetic engineering of organisms having unique characteristics.
- (b) The training of students to develop confidence in appreciating and solving problems in general as well as development of self confidence in handling problems with minimal or no supervision.
- (c) To display proficiency in basic microbiological skills; communicate the fundamental concepts of microbiology, both in written and in oral format; analyze, interpret and evaluate a range of scientific literature in microbiology.
- (d) Our students are trained such that they can collaborate with other scientists locally, nationally, and internationally as well as to provide valuable information for a variety of collaborative projects in microbiology.

(e) Building up of students' capacity to fit into the appropriate level of manpower to which their qualification will allow them in various employment opportunities available to microbiologists.

(f) Production of Microbiologists that can be self employed and possibly employer of labour. Also, we train students to be able to ease into postgraduate training without difficulty.

(g) Graduates have found research positions in biotechnology and pharmaceutical companies, as well as in state and government positions hiring microbiologists.

Microbiology graduates from Madonna University are suitable for careers in industries, hospitals, agricultural establishments, environmental studies, research institutes, veterinary laboratories and for specialized post graduate training.

### **SCOPE**

Industrial Microbiology

Medical Microbiology

Environmental Microbiology

Pharmaceutical Microbiology

### **ADMISSION REQUIREMENTS**

#### ***a). UTME Entry Requirements***

The Department of microbiology of Madonna University Elele campus offers courses leading to B. Sc. (Honours) degree in Microbiology. Admission is either by entrance examination (UTME) or Direct Entry. Students admitted through entrance examination undergo a four years degree course.

Students applying to read the four years programme for the award of Bachelor of sciences in Microbiology of Madonna University must satisfy the minimum University Matriculation Requirements. Such students must have at least five credit passes in biology, chemistry, mathematics, physics, and English language at WAEC, G. C. E. O/ Levels or its equivalents in not more than two sittings.

#### ***b) Direct Entry***

Students for Direct entry admission into a three years programme, are expected in addition, to have a minimum of two (2) passes at G.C.E. A/ Level or an equivalent certificate (IJMB) in not more than two sittings in Biology and any of; Chemistry, Geology, Mathematics or Physics. Students who have obtained national Diploma in Science Laboratory Technology are also eligible for direct entry into 200 Level. Students who enrolled and have spent one successful year in other Faculties in Madonna University can also transfer to Microbiology Department provide they met the minimum UTME requirement at the time of their admission into the institution.

## GRADUATION REQUIREMENTS

Students are required to complete a minimum of 120 units for Graduation, 60 of which must come from the student's discipline. The maximum period of stay for a student is six years. Any student who cannot graduate after six years shall be delisted from the Department.

**Learning Outcomes:** All Bachelors of honours degree student in Microbiology are expected to develop the following abilities and skills: a. *Regime of Subject Knowledge* Cognitive abilities and skills relating to solution of problems in Microbiology b. *Competencies and Skills* Practical skills relating to the conduct of laboratory and industrial work in Microbiology c. *Behavioral Attitudes* General skills relating to non-subject specific competencies, communication, ICT knowledge, interpersonal, organization skills and ethical standards.

**Attainment Levels:** Graduates of Microbiology are expected to have the ability to apply knowledge and skills to solving theoretical and practical problems in Microbiology in relation to national and societal problems.

## DEFINITION OF TERMS USED

**General Study Courses:** A course which every student in the University must compulsorily take and pass at foundation level. There are not directly related any programme, but are necessary in the holistic formation of students before graduation.

**Core/Compulsory Course:** A course which every student must compulsorily take and pass in Microbiology at a particular level of study.

**Required ancillary Course:** A course that you take at a level of study and must be passed before graduation.

**Elective Course:** A course that students take within or outside the faculty. Students shall choose an elective course from among three others in order to make up the required additional units for the award of the degree. Students may graduate without passing the course provided the minimum credit unit for the course had been attained.

**Optional Course:** A course which students can take based on interest and may count towards the minimum credit unit required for graduation

**Pre-requisite Course:** A course which student must take and pass before taking a particular course at a higher level.

**Minimum Credit Load Per Semester:** The Minimum credit load per semester is 15.

**Course Credit Unit System:** This should be understood to mean a 'quantitative system of organization of the curriculum in which subject areas are broken

down into unit courses which are examinable and for which students earn credit(s) if passed'. The courses are arranged in progressive order of difficulty or in levels of academic progress, e.g. Level or year 1 courses are 101, 102 etc. and Level II or Year II courses are 201, 202 etc. The second aspect of the system is that courses are assigned weights called Credit Units.

**Grade Point Average (GPA):** Performance in any semester is reported in Grade Point Average. This is the average of weighted grade points earned in the courses taken during the semester. The Grade Point Average is obtained by multiplying the Grade Point average in each course by the number of Credit Units assigned to that course, and then summing these up and dividing by the total number of Credit Units taken for the semester

**Cumulative Grade Point Average (CGPA):** This is the up-to-date mean of the Grade Points earned by the student in a programme of study. It is an indication of the student's overall performance at any point in the training programme. To compute the Cumulative Grade Point Average, the total of Grade Points multiplied by the respective Credit Units for all the semesters are added and then divided by the total number of Credit Units for all courses registered by the student

**Goal and Objectives of General Studies (GST) Courses:** The goal of GST courses is to produce a well-rounded, morally and intellectually capable graduates with vision and entrepreneurial skills in an environment of peace and social cohesiveness.

The objectives of the General Studies programme consist of the following: a) Acquisition development and inculcation of the proper value-orientation for the survival of the individual and society. b) The development of intellectual capacities of individuals to understand, appreciate and promote peaceful co-existence of people with a view to inculcating in them mutual understanding and patriotism. d) Exposing graduates of Nigerian Universities to the rudiments of ICT for computer literacy and ability to live usefully in this ICT age. e) Preparing students for a post university life with opportunities for job creation and entrepreneurial skills. f) Production of graduates capable of communicating effectively (both oral and written).

## **JOB OPPORTUNITIES IN MICROBIOLOGY**

### **In Sickness and in Health**

Microbiologists play a major part in finding ways of identifying, preventing and treating infectious diseases such as TB, a bacterial disease, and the viral infection 'flu. Microbiologists are also helping to pioneer gene therapy techniques against genetic disorders such as cystic fibrosis and inherited cancers. Viruses are used to introduce genes carrying the desired characteristic into the cell nuclei of the host organism. Gene technology also has many applications in the development of medicines and diagnostics.

### **Hospitals**

Microbiologists in hospital laboratories (Biomedical Scientists) deal with samples from patients, isolating and identifying the microbes that cause illness and giving advice on appropriate treatment. They also try to prevent patients from picking up infections in wards or operating theatres, and to trace and eliminate any infections which may occur. Opportunities exist too in the National Blood Service and veterinary establishments.

### **Health Protection Agency (HPA)**

The prevention of disease has a far greater impact on the population at large than the treatment of sick people. Microbiologists in the HPA monitor pathogens from patients and the environment. In this way, a disease can be tracked and if there is risk of an epidemic, vulnerable people can be immunized against it.

Microbiologists in HPA laboratories (like their hospital colleagues) isolate and identify pathogens. Their records are analysed centrally by computer to provide a continuous picture of the progress of infections and the information is used by health authorities in the control of disease.

HPA microbiologists also track down the restaurant kitchen or batch of factory-prepared food that are the source of a *Salmonella* food poisoning outbreak, or find the air-conditioning system harboring the *Legionella* bacteria responsible for an outbreak of Legionnaire's disease.

Food, milk and water supplies are also routinely tested to ensure that they are of good microbiological quality and not contaminated. There are two central and about 50 local HPA laboratories employing microbiologists in the UK. A number of private laboratories also carry out this kind of work.

### **Microbial Genomics**

Some microbiologists study the structure and function of microbial genomes, sequencing and identifying the genes of organisms which cause illness. We hope this knowledge will lead to better design of therapies against individual pathogenic organisms. This technology is also used to improve understanding of beneficial microbes such as those living in the gut.

### **Medical research**

Medical microbiologists also work in research institutes and universities where they study topics such as how diseases develop or the interaction between pathogenic microbes and host cells.

Some industrial research and development sites employ medical microbiologists to work on the development of medicines and vaccines. There are over 550 bioscience companies in the UK employing more than 40 000 people many of whom are microbiologists.

They carry out research and develop new products; they also work in quality control to monitor manufacturing processes and check the microbiological safety of goods. Other work is done away from the laboratory. Some of these jobs and industries are described in more detail below.

### **Biochemicals**

Microbiologists are involved in the production and quality testing of many other useful compounds, including amino acids, antiseptics, organic acids and proteins. Using microbes to produce enzymes for scientific use is an industry in its own right. Many diagnostic procedures in clinical biochemistry use microbial enzymes, and a long list of bacterial enzymes is sold for use in molecular biology techniques like DNA "fingerprinting".

We all know the benefits of adding (microbial) enzymes to washing detergents. Clothes can be cleaned at lower temperatures, using less detergent and water softener in the powder, leading directly or indirectly to reduced pollution. Some enzymes used in the food industry are also made on a large scale from microbes.

### **Cosmetics & Toiletries**

Microbiologists check the effectiveness of anti-microbial products such as creams against acne and anti-dandruff shampoos and develop preservative systems to ensure that cosmetics and toiletries are free from microbial contamination both during manufacture and use by the consumer.

### **Food and Drink Manufacture**

Microbial fermentations have been used for centuries to produce foods such as cheese and yoghurt and alcoholic beverages like wine and beer. Microbiologists are also needed at all stages of modern food and drink manufacturing processes. They are involved in the maintenance of the microbial culture (the inoculum) that is used to start the fermentation of the milk or grape juice, to prevent deterioration of existing strains and to develop or improve existing ones.

Olives and some processed meats are made by fermentation. However, the best known fermented products are beer, wine and spirits - the brewing industry is a major commercial force employing many microbiologists. Some beers are still produced by traditional methods, but in the main, brewing is a strictly controlled operation. Microbiologists maintain the strains of yeasts used and produce improved strains, as well as supervising the fermentation. They also have to solve the problem of dealing with waste materials produced by the process.

Our food contains many other, less obvious, microbial products, such as flavours and colours. Many factory-produced foods lose important vitamins during processing, and to keep our diet healthy, vitamins are added back to the

food (e.g. breakfast cereals). These vitamins are made by high yielding bacterial strains and are a relatively inexpensive ingredient.

### **Safety & hygiene**

As we store food for longer periods, it becomes more difficult to prevent spoilage by microbes. Some spoilage just makes food look unattractive but food poisoning is caused by human pathogens such as *Salmonella* growing on food. The increased demand for production and storage of ready meals, has caused in a rise in the number of cases of food poisoning by the bacteria *Listeria* and *Campylobacter*. Microbiologists are employed in quality control to ensure that products are safe and wholesome; in product development and basic research into food hygiene and preservation.

### **Water**

We need plenty of good quality water for domestic and industrial purposes. Rivers and reservoirs supply water to purification plants where microbiological and chemical tests are carried out to check its quality before distribution. The action of bacteria and protozoa in sewage treatment plants breaks down waste material so that effluent can safely be released back into the rivers. Microbiologists in water companies and the Environment Agency monitor and control these processes.

### **In the field**

Microbes play an important part in agriculture. They fix nitrogen in the soil into a form that can be used by plants as a fertilizer and turn grass into the winter animal feed, silage. Microbiological research in these and other agricultural topics is carried out in institutes and industry.

Farm animals and crops are susceptible to pests and diseases. Veterinary microbiologists and plant pathologists do research and give advice on problems farmers may encounter.

Microbes are also used for biocontrol. Pests or weeds can be sprayed with a microbe that attacks them instead of spraying crops with pesticides or herbicides which kill many types of harmless organisms. Biocontrol has great potential, particularly in developing countries where a sustainable method of crop protection is the preferred approach.

### **The environment**

Microbiologists in research institutes and universities study the ecology of microbes in fresh water, the sea and other habitats. Microbial activities can be harnessed to avoid or minimise environmental pollution. Factory wastes are treated with suitable cultures or enzymes produced from bacteria. Microbes can also be used in production processes. For example, microbes can be used to replace harmful chemicals in dye production and leather processing.

Some parts of our environment are already badly damaged by pollution. Industrial processes (and accidents) have left land contaminated with such things as toxic heavy metals and phenolic compounds. Microbial processes are being developed to clean up such pollution - known as bioremediation.

Many microbiologists apply their knowledge and skills in work outside of the laboratory. There are opportunities in the civil service, local government, industry and commerce. One example is sales and marketing of pharmaceutical products or laboratory equipment and consumables. A period of laboratory experience helps a sales consultant understand the concerns of microbiology focused customers.

Another area of work is in information science and librarianship. Some microbiologists become technical or science writers or work for scientific publishers, editing journal articles or books.

Others go into the law and accountancy where scientists are popular with recruiters. The biotechnology business boom has resulted in many more jobs for technology transfer specialists, business development managers and patent lawyers who need to have a sound grasp of the scientific basis of the subject.

Some microbiology graduates undertake teacher training and go on to work in schools or further education colleges. A few lectureships in universities are available, but candidates must usually have obtained a postgraduate qualification such as a PhD and worked for several years as a researcher.

## **STRESS AREAS**

General Courses	0
Industrial/ Food Microbiology	1
Environmental Microbiology	2
Soil and Agricultural Microbiology	3
Medical Microbiology	4
Pharmaceutical Microbiology	5
Microbial biotechnology	6
Research methods	7
Seminar	8
Project	9

## COURSE CODING

A course is coded by a combination of three letters and three digits. The three letters code stands for the Department offering the course. Microbiology courses are coded as MCB. For the three digits numbers, the first digits indicates the year of study, the second indicates the subject stress area while the third digit shows the semester. First semester are represented with odd numbers while second semesters are represented with even numbers.

## COURSES REGISTRATION

All students shall register for courses within the first week of assumption/resumption in the semester. Students who fail to register as stated shall be considering for late registration within the second week of the semester. Any student who fails to register within the first two weeks of the semester shall be advice to defer the semester. Only in special circumstances and through the approval of the Vice Chancellor on behalf of the Senate, may a student be allow to register after two weeks but not more than four weeks into the semester. An application for late registration shall attract a prescribed fee.

## COURSE EVALUATION

**Course Credit System** This should be understood to mean a `quantitative system of organization of the curriculum in which subject areas are broken down into unit courses which are examinable and for which students earn credit(s) if passed'. The courses are arranged in . progressive order of difficulty or in levels of academic progress, e.g Level or year 1 courses are 100,101etc.,and Level II or Year II Courses are 211, 212 etc. The second aspect of the system is that courses are assigned weights referred to as Credit Units.

### **Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)**

Performance in any semester is reported in Grade Point Average. This is the average of weighted grade points earned in the courses taken during the semester. The Grade Point Average is obtained by multiplying the Grade Point Average in each 7 course by the number of Credit Units assigned to that course, and then summing these up and dividing by the total number of Credit Units taken for the semester.

This is the up-to-date mean of the Grade Points earned by the students in a programme of study. It is an indication of the student's overall performance at any point in the training programme. To compute the Cumulative Grade Point Average, the total of Grade Points multiplied by the respective Credit Units for all the semesters are added and then divided by the total number of Credit Units for all courses registered by the student.

**Techniques of Students Continuous Assessment**

Students shall be examined by a combination of the following methods:

(a) Un-announced Quizzes; (b) Class Examinations; (c) Home-Work Assignments; (d) Mid-Semester and Final Semester Examinations.

The above methods can be carried out through any of the established techniques such as: (i) Term Papers; (ii) Oral presentation at examinations; (iii) Seminars; (iv) Projects; and (v) Written essay or objective examinations etc.

**Final Semester Examinations**

The weights to be attached to these examinations is such that the final semester examination carries 70 % for taught based modules, 60 % for practical based modules and 50 % for oral based module.

**Probation:** Probation is a status granted to a student whose academic performance falls below an acceptable standard. A student whose Cumulative Grade Point Average is below 1.50 at the end of a particular year of study, earns a period of probation for one academic session.

**Withdrawals:** A candidate whose Cumulative Grade Point Average is below 1.50 at the end of a particular period of probation should be required to withdraw from the University. However, in order to minimize waste of human resources, consideration should be given to withdrawal from programme of study and possible transfer to other programmes within the same University

**Repeating Failed Course Unit(s):** Subject to the conditions for withdrawal and probation, student may be allowed to repeat the failed course Unit(s) at the next available opportunity, provided that the total number of credit units carried during that semester does not exceed 24, and the Grade Points earned at all attempts shall count towards the CGPA.

**External Examiner System**

External Examiners should be used only in the final year of the undergraduate programme to assess final year courses and projects, and to certify the overall performance of the graduating students as well as the quality of facilities and teaching. However, the existing practice of using External

## DEGREE CLASSIFICATIONS

Table 1: Scoring and Grading Systems

(i) Credit Units	(ii) Percentile Scores	(iii) Letter Grades	(iv) Grade Points (GPA)	(v) Grade Point Average (CGPA)	(vi) Cumulative Grade Point Average	(vii) Class of Degree
Vary According to contact hours assigned to each course per week per semester and according to work load carried by student	70-100	A	5	Derived by Multiplying i and iv and dividing by total Credit Units	4.5 – 5	First Class
	60-69	B	4		3.50 - 4.49	2 <sup>nd</sup> Class Upper
	50-59	C	3		2.40 – 3.49	2 <sup>nd</sup> Class Lower
	45-49	D	2		1.50 – 2.39	Third Class
	0-44	F	1			

**INSTRUCTION TO DIRECT ENTRY STUDENTS**

Students who gained admission by direct entry into the 200 level will ensure that they register and pass the following General Studies Courses in addition to all the courses in the Faculty/Departmental curriculum, as applicable.

**FIRST SEMESTER (FOR DIRECT ENTRY STUDENTS)**

<b>Course Code</b>	<b>Course Title</b>	<b>Unit</b>	
GST 111	Communication in English I	2	
GST 113	Nigerian Peoples and Culture	2	
GST 121	Use of Library, Study Skills and Information Technology	2	
GST 123	Communication in French	2	
GST 125	Introduction to Entrepreneurship Studies I		2

**SECOND SEMESTER (FOR DIRECT ENTRY STUDENTS)**

<b>Course Code</b>	<b>Course Title</b>	<b>Unit</b>	
GST 104	Fundamental Philosophy	1	
GST 112	Logic, Philosophy and Human Existence	2	
GST 122	Communication in English II	2	
GST 142	Communication in German	2	
GST 162	Introduction to Social Science	2	

**COURSES OFFERED IN 100 LEVEL OF STUDY  
FIRST SEMESTER**

<b>CODE</b>	<b>COURSE TITLE</b>	<b>UNIT</b>
<b>REQUIRED ANCILLIARY COURSES</b>		
BIO 101	GENERAL BIOLOGY I	3
CHM 101	GENERAL CHEMISTRY I	3
PHY 101	GENERAL PHYSICS I	3
MTH 101	GENERAL MATHEMATICS I	3
CHM 171	BASIC PRACTICAL CHEMISTRY I	1
<b>GENERAL STUDIES COURSES</b>		
GST 111	COMMUNICATION IN ENGLISH I	2
GST 113	NIGERIAN PEOPLES AND CULTURE	2
GST 121	USE OF LIBRARY, STUDY SKILLS AND INFORMATION COMMUNICATION TECHNOLOGY (ICT)	2
GST 123	COMMUNICATION IN FRENCH	2
GST 125	INTRODUCTION TO ENTREPRENEURSHIP STUDIES I	2
<b>TOTAL</b>		<b>23</b>

**SECOND SEMESTER**

<b>CODE</b>	<b>COURSE TITLE</b>	<b>UNIT</b>
<b>REQUIRED ANCILLIARY COURSES</b>		
BIO 102	GENERAL BIOLOGY II	3
CHM 102	GENERAL CHEMISTRY II	3
CHM 122	ORGANIC CHEMISTRY I	1
MTH 102	GENERAL MATHEMATICS II	3
CSC 104	INTRODUCTION TO COMPUTER SCIENCES	2
PHY 102	GENERAL PHYSICS II	3
BIO 172	GENERAL BIOLOGY PRACTICAL	1
<b>GENERAL STUDIES COURSES</b>		
GST 102	FUNDAMENTAL PHILOSOPHY	1
GST 112	LOGIC, PHILOSOPHY AND HUMAN EXISTENCE	2
GST 122	COMMUNICATION IN ENGLISH II	2
GST 142	COMMUNICATION IN GERMAN	1
GST 162	INTRODUCTION TO SOCIAL SCIENCES	2
<b>TOTAL</b>		<b>24</b>

**COURSES OFFERED IN 200 LEVELS  
FIRST SEMESTER**

CODE	COURSE TITLE	UNIT
<b>CORE COURSES</b>		
MCB 201	GENERAL MICROBIOLOGY I	3
<b>REQUIRED ANCILLARY COURSES</b>		
BIO 211	INTRODUCTORY GENETICS	2
ZOO 211	INVERTEBRATE ZOOLOGY	3
BIO 221	INTRODUCTORY ECOLOGY	3
BCH 201	GENERAL BIOCHEMISTRY I	3
CHM 213	PHYSICAL CHEMISTRY II	2
CHM 221	ORGANIC CHEMISTRY II	2
FST 211	INTRODUCTION TO FOOD SCIENCE	3
<b>GENERAL STUDIES COURSES</b>		
GST 211	FUNDAMENTAL THEOLOGY	1
GST 215	INTRODUCTION TO ENTREPRENEURSHIP STUDIES II	2
<b>TOTAL</b>		<b>24</b>

**SECOND SEMESTER**

CODE	COURSE TITLE	UNIT
<b>CORE COURSES</b>		
MCB 202	GENERAL MICROBIOLOGY II	3
MCB 204	BASIC TECHNIQUES IN MICROBIOLOGY	2
MCB 242	BASIC MYCOLOGY AND PHYCOLOGY	3
MCB 262	INTRODUCTION TO BIOTECHNOLOGY	2
<b>REQUIRED ANCILLARY COURSES</b>		
BIO 222	CELL BIOLOGY AND PHYSIOLOGY	3
BIO 272	GENERAL TECHNIQUES IN BIOLOGY	2
CHM 212	INORGANIC CHEMISTRY II	2
STA 212	STATISTICS FOR BIOLOGICAL SCIENCES	3
<b>GENERAL STUDIES COURSES</b>		
GST 222	STUDIES IN PEACE AND CONFLICT RESOLUTION	2
GST 224	FUNDAMENTAL ETHICS	1
GST 252	BIOETHICS	1
<b>TOTAL</b>		<b>24</b>

## COURSES OFFERED IN 300 LEVELS

## 1st Semester

CODE	COURSE TITLE	UNIT
<b>Core courses</b>		
MCB 301	MICROBIAL PHYSIOLOGY AND METABOLISM	3
MCB 303	BACTERIAL DIVERSITY	3
MCB 311	FOOD AND DAIRY MICROBIOLOGY	3
MCB 321	ENVIRONMENTAL AND AQUATIC MICROBIOLOGY	3
MCB 331	SOIL AND AGRICULTURAL MICROBIOLOGY	3
MCB 361	MICROBIAL GENETICS AND MOLECULAR BIOLOGY	3
<b>ELECTIVES (Choose one)</b>		
MCB 323	BIODETERIORATION	3
BCH 371	ENZYMOMOLOGY	3
ZOO 331	BIOLOGY OF TROPICAL PARASITES	3
CSC 303	COMPUTER APPLICATION FOR BIOMEDICAL SCIENCES	3
<b>TOTAL</b>		<b>21</b>

## SECOND SEMESTER

CODE	COURSE TITLE	UNIT
MCB 312	INDUSTRIAL TRAINING (SIWES)	15
<b>TOTAL</b>		<b>15</b>

## COURSES OFFERED IN 400 LEVEL OF STUDY

## 1st SEMESTER

CODE	COURSE TITLE	UNIT
MCB 421	MICROBIAL ECOLOGY	3
MCB 441	VIROLOGY	3
MCB 443	PRINCIPLES OF EPIDEMIOLOGY AND PUBLIC HEALTH MICROBIOLOGY	3
MCB 451	PHARMACEUTICAL MICROBIOLOGY	3
MCB 461	IMMUNOLOGY & IMMUNOCHEMISTRY	3
MCB 471	RESEARCH METHODOLOGY	2
MCB 481	SEMINAR IN MICROBIOLOGY AND BIOTECHNOLOGY	2
<b>ELECTIVES (Choose one)</b>		
ZOO 421	PRINCIPLES OF PARASITOLOGY	3
BOT 411	INTRODUCTION TO PLANTS DISEASES	3
BOT 431	PLANTS AND ENVIRONMENTAL POLLUTION MONITORING	3
<b>TOTAL</b>		<b>22</b>

## SECOND SEMESTER

CODE	COURSE TITLE	UNIT
MCB 412	ANALYTICAL MICROBIOLOGY AND QUALITY ASSURANCE	2
MCB 414	INDUSTRIAL MICROBIOLOGY	3
MCB 422	PETROLEUM MICROBIOLOGY	3
MCB 442	PATHOGENIC MICROBIOLOGY	3
MCB 492	RESEARCH PROJECT IN MICROBIOLOGY	6
<b>ELECTIVES (Choose one)</b>		
MCB 410	INTRODUCTION TO MUSHROOM GROWING TECHNOLOGY	2
MCB 416	ADVANCED FOOD MICROBIOLOGY	2
MCB 424	PLANTS & ENVIRONMENTAL POLLUTION MONITORING	2
<b>TOTAL</b>		<b>19</b>

**COURSES DESCRIPTION FOR BACHELOR OF SCIENCE  
(B. Sc.) DEGREE IN MICROBIOLOGY**

**FIRST YEAR COURSES**

**GENERAL COURSES**

**GST 111 COMMUNICATION IN ENGLISH I (2 UNITS)**

Effective communication and writing in English language skills. Writing of essay, letters, speeches, public announcements, minutes of meetings and term papers. Reading and listening comprehension. Construction of Sentences, outlines and paragraphs. Collection and organization of materials and logical presentation/punctuation.

**GST 113 NIGERIA PEOPLE AND CULTURE (2 UNITS)**

Study of Nigeria history, culture and arts in pre-colonial times. Nigerian's perception of his world. Nigerian cultures and their characteristics. Evolution of Nigeria and their characteristics. Evolution of Nigeria political system, Indigene/settler phenomenon. Concepts of trade, Economic self reliance, Social justice, Individual and national Development, Norms and values, Negative attitudes and conducts (cultism and related vices), Re-orientation of moral and national values, Moral obligations of citizens and Environmental problems.

**GST 121 USE OF LIBRARY, STUDY SKILLS AND INFORMATION, COMMUNICATION TECHNOLOGY ICT (2 UNITS)**

Brief history of libraries, library and education, university libraries and other types of libraries, study skills (reference services). Types of library materials, using library resources including e-learning, e-materials etc. understanding library catalogues(CARD OPAC etc) and classification, copyright and its implications, Database resources, Bibliographic citations and referencing. Development of modern ICT, hardware technology, software technology, input devices, storage devices, output devices, word processing skills (typing, etc).

**GST123 COMMUNICATION IN FRENCH (2 UNITS)**

Introduction to French, alphabets and numeracy for effective communication (written and oral) conjugation and simple sentence construction based on communication approach, sentence construction, comprehension and reading of simple text.

**GST 125 INTRODUCTION TO ENTREPRENURIAL STUDY I (2 UNITS)**

Introduction to entrepreneurship and new venture creation; entrepreneurship in theory and practice, The opportunity, forms of business, staffing, marketing and

the new venture; Determining capital requirements, Raising capitals, financial planning and management; starting a new business feasibility studies, innovation; legal issues; insurance and environmental considerations.

**BIO 101 GENERAL BIOLOGY I (3 UNITS)**

**Unit I:** Cell structures and organization; Plant and animal cells, Function of cellular organelles; diversity and characteristics of living things.

**Unit II:** General reproduction; mitosis, meiosis, abnormalities associated with gene crossing, heredity and evolution.

**Unit III:** Concept of ecology and types of habitats diversity of plants and animals. Food chains and food webs; interrelationship of organisms. Types of population dynamics, static, climax communities, types and factors affecting them. \*Edaphic factors, rainfall, wind, relative humidity, light intensity etc. \*Modification of the natural ecosystem.

**Unit IV:** Elementary biochemistry of carbohydrates, protein, lipid and nucleic acids.

**REQUIRED ANCILLARY****CHM 101 GENERAL CHEMISTRY I (3 UNITS)**

Atoms, molecules and structures. Electronic configuration. Periodicity and building up of the periodic table. Periodicity and building up of the periodic table. Chemical reactions, chemical equations and stoichiometry. Bonding and intermolecular forces. Kinetic theory of matter, derivation and calculation of all the laws involved. Thermochemistry and simple calculation based on Hess's law. Rate of reaction. Chemical equilibrium Oxidation – Reduction reaction. Chemical Kinetics, equilibria and related simple calculation. Important application of equilibria like, Solubility. Solubility of ionic solids. Electrochemistry and workings of various cells Corrosion

**CHM 171 BASIC PRACTICALS CHEMISTRY I (I UNITS)**

The theory and practice of simple volumetric and qualitative analysis. Simple organic preparations, reaction of functional groups and physical determinations.

**PHYS 101 GENERAL PHYSICS I (3 UNITS)**

Measurements, Units and Dimensions. Linear motion. Relevance of linear kinematics to science and physiological affects of accelerations. Motion in a circle and simple harmonic motion. Gravitation, statics and hydrostatics, elasticity, friction, viscosity and surface tension. Heat, temperature, thermometers. Expansion of solids, liquids and gases. Gas exchanges in terrestrial organism. Heat transfer, change of state. Heat regulation in animals, low temperature in biology and in medicine. Waves and resonance ultra sound and its application. Practicals: General measurements and error analysis, simple

experiments in mechanics and properties of matter. Heat and thermodynamics. Kinetic model of gas, A model for solid. Properties of metals

### **MTH 101: GENERAL MATHEMATICS I (3 UNITS)**

Real number system: simple definitions of integrals, rational and irrational numbers. The principle of mathematical induction. Real sequences and series: elementary notion of convergence of geometry, arithmetic and other simple series. Theory of quadratic equations. Simple inequalities: absolute values and the triangle inequality. Identities, partial fraction.

Sets and subsets: union, intersection, compliments. Properties of some binary operations of sets: distributive, closure, associative, commutative laws with examples. Relations in a set: equivalence relation. Properties of set functions and inverse set functions.

Permutations and combinations. Binomial theorems of any index. Circular measures, trigonometric function of angles of any magnitudes. Addition and factor formulae. Complex numbers: algebra of complex numbers, the Argand diagram, De Moivre's theorem, n-th root of unity.

### **GST112 LOGIC, PHILOSOPHY AND HUMAN EXISTENCE (2 UNITS)**

A brief survey of the main branches of philosophy, logic special symbols in symbolic logic conjunctions, negation, affirmation, disjunction, equivalent and conditional statement laws of torts. The method of deduction using rules of inference and bi-conditionals qualification theory. Types of discourse, Nature of arguments, validity and soundness, Distinction between deductive and inductive inferences. Etc. illustration will be taken from familiar texts including literature materials, Novels, law reports and news paper publications.

### **GST 122 COMMUNICATION IN ENGLISH 11 (2 UNITS)**

Logical presentation of papers, phonetics, instruction of lexis, Arts of public speaking and oral communication, figures of speech, precise report writing.

### **BIO 102 GENERAL BIOLOGY II (3 UNITS)**

**Unit I:** Levels of organization. Origin and History of classification. Principles of Binomial nomenclature. Hierarchical classification. Molecular classification of bacteria. structure, morphological features and chemical nature of viruses.

**Unit II:** Kingdom monera; Habitat, structure and morphological characteristics and life cycle of; Cyanobacteria, Archaeobacteria, Eubacteria.

**Unit II:** Kingdom Protista;- Habitat, structure and morphological characteristics and life cycle of protozoans, algae and slime moulds.

**Unit IV:** Kingdom Mycota;- Habitat, structure and morphological characteristics and life cycle of; ascomyctes, deuteromyctes, zygomycytes and oomycytes

**Unit V:** Kingdom Plantae- Habitat, structure and morphological characteristics of bryophytes, pteridophytes, gymnospermae and angiospermae.

**Unit VI:** Kingdom animalia;- Invertebrate and origin of animal diversity. Symmetry, cephalisation and gastrulation. Habitat, structure and morphological characteristics and life cycle of porifera, cnideria, platyhelminthes, nermetines, rotifers, nematode, acanthocephalia, annelid, mollusca, Echinodermata, and chordate.

### **BIO 172 PRACTICAL BIOLOGY (1 UNIT)**

**Unit I:** Testing for the presence of food substances, Diffusion and osmosis experiments. Observation of cells and tissues of selected plants and animal species.

**Unit II:** Investigations on physiological processes affecting photosynthesis. Observation of mitosis in onion bulb. Observation of cyst and ova of parasitic worms.

**Unit III:** Observation of fungi hyphae, and spores, bacteria cells, protozoan specimens and algae. Observation of Plant specimens. Observation of invertebrate animal specimens. Preparation of microscopic slides.

**Unit IV:** Basics of photometry, colorimetry, chromatography, electrophoresis.

### **CHM 102 General Chemistry II (3 Units)**

Structure of solid. Kinetic theory of gases and laws. Colligative properties of dilute solutions. Raoult's law, Henry's law and molecular weight determination. Thermochemistry and Hess's law. Chemical Equilibrium. Law of mass action, reaction rate and chemical energetic. Electrochemistry. Ionic equilibrium. Theory of acids bases and indicators. Catalysis. Ionics, phase equilibrium, one and two component system. Enthalpy, Entropy and Free energy.

### **CHM 122: Organic Chemistry I (1 Unit)**

Historical survey of the development and importance of organic chemistry. IUPAC nomenclature and classification of organic compounds. Homologous series Elemental analysis and molecular formula, structural Isomerism Isolation and purification methods concept of functional group resonance and aromaticity. Electronic theory in organic chemistry (brief). Saturated and unsaturated hydrocarbons, cyclic hydrocarbons, alcohols, alkyl halides, ethers, aldehydes and ketones, carboxylic acids, amines and aromatic compounds, comparison on phenols with alcohols.

### **PHYS 132 GENERAL PHYSICS II (3 UNITS)**

Propagation of light at plane and curved surfaces. The human eye photosensitive pigments in the eye, colour vision and the insect eye. Optical instruments: Ophthalmoscope and compound microscope. Radioactivity and useful effects of radiation. Current and static electricity, introductory

magnetism and alternating currents. Introductory atomic physics and electronics. Practicals: Vibrations, Wave and Optics Magnetism

**MTH 102 GENERAL MATHEMATICS III (3 UNITS)**

This course is a continuation of the course MTH III. The main areas to be covered include; Axioms of real numbers, Absolute values, Real values functions, Properties, Domain of function, Limit of functions, Continuity, Differentiability, Integreability. The abstract definitions of these concepts should be stated; prove of limit existence theorems, finding limits of functions, proving continuity of functions, differentiating and integrating functions. Techniques of limit, differentiation and integration.

**CSC 104 INTRODUCTION TO COMPUTER SCIENCE (2 UNITS)**

The meaning of a computer origin, classification: Analog, Digital and Hybrid. Types of Digital computers: mainframe, mini and microcomputer models of digital computers, modes of computer operations. The generation of computer types, the meaning of a programme and a “job”. The two levels of computer software: The high-level and low-level. The computer and the language levels. Examples of systems software, Interpreters, compilers, and translators. The function of system software; the functional units of a digital computer; Examples of application software packages. Data processing and data processing centers. Criteria for using a computer. Type of computer users’ interface. The types of printers. Introduction of the internet.

**SECOND YEAR COURSES****GST 215 INTRODUCTION TO ENTREPRENURIAL STUDIES II (2 UNITS)**

Possible business opportunities in Nigeria. Some of the ventures to be focused upon include the following; 1. Soap/detergent, tooth brushes and tooth paste making 2. Photography, 3. Brick, nails, screws making 4. Dyeing /Textile blocks paste making 5. Rope making 6. Plumbing 7. Vulcanising 8. Brewing 9. Glassware production 10. Paper production 11. water treatment/conditioning/packaging 12. Food processing/ packaging/ preservation 13. Metal working/fabrication- steel and aluminum doors and windows 14. Training industry 15. Vegetable oil/salt extractions 116. Fisheries/Aquaculture 17. Refrigeration / Air conditioning 18. Plastic making 19. farming(crop) 20. Domestic electrical wiring 21. Radio/TV repairs 22. Carving 23. Weaving 24. Brick laying/Making 25. Bakery 26. Tailoring 27. Iron welding 28. Building drawing 29. Carpentry 30. Leather training 31. Interior decoration 32. Printing 33, Animal husbandry (poultry, piggery, goat etc). 34. Medial craft, blacksmith, tinsmith etc. 35. Sanitary wares 36. vehicle maintenance 37. Bookkeeping.

**MCB 201 GENERAL MICROBIOLOGY I (3 UNITS)**

**Unit I:** History and scope of microbiology science. Microbes as causes of diseases; theory of spontaneous generation; hygiene and prevention of infections; viruses as parasites; development of antimicrobial compounds;

**Unit II:** General principles in cultivation and isolation of microorganisms: preparation of culture media; types of culture media: simple media, complex media, synthetic media, enriched media, selective media, indicator media, differential media, anaerobic media; Pure culture techniques: streak plate, pour plate and spread plate method; maintenance of pure culture; methods of preservation of various microbes.

**Unit III:** Basic principles and methods of sterilization; control of microorganisms by physical methods: heat, filtration and radiation; chemical methods: phenolics, alcohols, halogens, heavy metals, quaternary ammonium compounds, aldehydes and sterilizing gases; evaluation of antimicrobial agent effectiveness. Principle and functioning of LAF

**Unit IV:** Principles of Microscopy: Staining techniques: Simple, Gram, Capsule, Flagella, Endospore, Nuclear, acid fast. Specimen preparation and basic principles for the examination of microbes by light, phase contrast, dark field, confocal, fluorescent and electron (transmission and scanning) microscopy; Micrometry and microdensitometry.

**Unit IV:** Structure, ecology and reproduction of representative microbial species. Anatomy of Prokaryotic cell structural components and functions; Fungal structures and adaptation.

### **BIO 211                    INTRODUCTORY GENETICS                    (2 UNITS)**

**Unit I:** History of genetics. Pattern, particle and principles of heredity (monohybrid and dihybrid inheritance). Complete, incomplete dominance and co dominance. Mendel's inheritance in human: Multifactorial inheritance.

**Unit II:** Sex determination, Sex linkages, Eukaryotic chromosome and theory of inheritance. Detail structure of DNA, mechanism of DNA replication. Basic and normal control of cell division (meiosis and mitosis). Replication of DNA, Genes expression (mutation, transformation and protein synthesis).

**Unit III:** Genetic recombination. Gene linkages and Gene mapping. Locating of Genes along a chromosome. Direct detection of genotypes. Genetic analysis of populations and how they evolve (Heritable and non heritable characteristics, quantitative inheritance). Structure and organization of Drosophila genome, sex determination in Drosophila. Diseases at the level of the gene (genic mutations), Recessive Disorders (homozygote recessive aa), Hemophilia - blood clotting problems.

**Unit IV:** Diseases due to recessive allele - sex-linked; Sickle-cell anemia. Phenylketonuria ; Galactosemia . Syndromes and Chromosomal disorders. Chromosomal rearrangements and Genetic Disease. Methods of Detection- Pedigree analysis. Origin of life on earth. Concept and theory of evolution.

**BIO 221 INTRODUCTORY ECOLOGY (2 Units)**

**Unit I:** Aims and scope of ecology. Basic units of ecology (Population, community and ecosystem)

**Unit II:** Biotic and abiotic components of an ecosystem. Production in ecosystems. Energy flow and nutrient cycling. Dynamics of population and communities

**Unit III:** Concept and definition of ecosystem, ecology at community level, ecological classification of habitat types, terrestrial and aquatic biomas, specific features of each, biotic components of habitat. Natural destruction, factors of communities, success of community interaction, natural cycle, dynamics of population

**Unit III:** Practicals: to include among others community and population studies of each species in a habitat. Succession simply treated

**BCH 201 GENERAL BIOCHEMISTRY I (3 UNITS)**

**(PRE-REQUISITES: BIO 111, 122; CHM 111, 122)**

**Unit I:** Experimental discoveries and the history of biochemistry. Contributions of the following biochemists to the subject: Nueberg, Emil Fisher, Warburg, Michaelis-Menten, Krebs, C. Cori and G Cori, Hills Ochoa, Calvin and Benson, Watson and Crick, Jacob, Monod, Niremberg, Sanger, Bornberg and others.

**Unit II:** Structures and functions of major cell components; Prokaryotic versus Eucaryotic organisms. Chemistry of amino acids, proteins and their derivatives; Methods of isolation and identification

**Unit III:** Chemistry and structures of carbohydrates, proteins, lipids and nucleic acids.

**CHEM 213 PHYSICAL CHEMISTRY II (2 UNITS)**

**PRE-REQUISITE -CHM 121**

**Unit I:** Wave mechanical treatment of atomic structure, Periodicity and periodic table. Chemical bonding. Bonding theories; Valences bond theory molecular orbital theories.

**Unit II:** Inorganic Stereochemistry, Nomenclature of Inorganic compounds. Chemistry of group IIIA, (boron group), VA (Nitrogen group), noble gas. Introduction to first row transition metal chemistry

**CHM 221: Organic Chemistry II (2 Units)**

**Pre-requisite CHM (122)**

Factors affecting structure and physical properties of organic compounds; factors availability of electrons at the reaction site, including theory of organic chemistry, orbital theory and hybridization classification of reagents and their reactions, Aromaticity, Stereochemistry, methane, energy of activation and free radical substitution reaction in alkanes. Functional group chemistry, various organic reactions e.g. addition, free radical, elimination reaction, etc.

**GST 222 STUDIES IN PEACE AND CONFLICT RESOLUTION****(2 UNITS)**

**Unit I:** Basic studies in peace studies and conflict resolution, peace as vehicle of unity and development, conflict issues, types of conflicts, e.g. ethnic/religious/political/economic conflicts, root causes of conflicts and violence in Africa, indigene/settler phenomenon, peace building, management of conflict and security, elements of peace studies and conflicts resolution

**Unit II:** developing a culture of peace, peace mediation and peace keeping, alternative dispute resolution (ADR) Dialogue/Arbitration in conflict resolution, role of international organization in conflict resolution e.g. ECOWAS, African union, united Nations etc.

**MCB 202 GENERAL MICROBIOLOGY II (3 Units)**

**Unit I:** Nutrition and biochemical activities of microorganisms. Antigens and antibodies. Identification and economic importance of selected microbial groups. Microbial variation and heredity.

**Unit II:** Nitrogen fixation in symbiotic and free living system, oxygen and hydrogen regulation of nitrogen fixation, nitrification, denitrification and ammonifying bacteria.

**Unit III:** Pathway of nitrate assimilation in photosynthetic and non-photosynthetic systems, transamination and deamination reactions.

**MCB 262 INTRODUCTION TO BIOTECHNOLOGY (2 UNITS)**

**Unit I:** General introduction to biotechnology and Fermentation. Microbial growth processes (mode of fermentation processes; design of a fermentor; achievement and maintenance of aseptic conditions in the fermentor). Major Biotechnological products & Bioconversion processes. Biodegradation and bioremediation.

**Unit II:** Gene therapy, applications, delivery mechanisms and drawbacks. Genetic engineering (applications; recombinant DNA technology; DNA cloning, hybridizations & sequencing). Introduction to Genetic Engineering, Fermentation of food, Production/Biosynthesis of enzyme, vitamins.

**Unit III:** In vivo labeling of DNA/RNA, Nick translation and DNA probes. Satellite DNA, unique and repetitive sequences, DNA renaturation and polynucleotide Hybridization, Northern blot, DNA sequencing, Restriction mapping, Recombinant DNA Technology and its application.

**Unit IV:** Principles and applications of Electrophoresis (one and two dimensional for proteins and DNA); Iso-electric focussing; pH and Buffers; Autoradiography, X-Ray Diffraction; Centrifugation; Ultracentrifugation; Dialysis and Ultrafiltration; Lyophilization in microbiological studies.

**MCB 242 BASIC MYCOLOGY AND PHYCOLOGY (2 UNITS)**

**Unit I:** Structure, life cycles, physiology and classification of fungi. Fungi of economical importance in industry and agriculture. Classification. Terminologies used in modern Mycology. The major groups and their probable relationships and Structure.

**Unit II:** function and growth of specified representatives of lower and higher fungi. Industrial mycology, Enzymes from fungi, mycotoxins. Mushrooms cultivation and significance.

### **MCB 204 BASIC TECHNIQUES IN MICROBIOLOGY (2 UNITS)**

**Unit I:** Instrumentations in Microbiology laboratories. Enumeration of microorganisms. Staining techniques. Biochemical characterization of bacteria.

**Unit II:** Principle & application of light, phase contrast, fluorescence, scanning & transmission electron microscope, Cytophotometry & flow cytometry, fixation & staining.

**Unit II:** Basic principles and methods of sterilization; control of microorganisms by physical methods: heat, filtration and radiation; chemical methods: phenolics, alcohols, halogens, heavy metals, quaternary ammonium compounds, aldehydes and sterilizing gases; evaluation of antimicrobial agent effectiveness. Principle and functioning of LAF.

**Unit III:** Preparation of culture media; types of culture media: simple media, complex media, synthetic media, enriched media, selective media, indicator media, differential media, anaerobic media; Pure culture techniques: streak plate, pour plate and spread plate method; maintenance of pure culture; methods of preservation of various microbes.

**Unit IV:** Microscopy: Staining techniques: Simple, Gram, Capsule, Flagella, Endospore, Nuclear, Acid fast. Specimen preparation and basic principles for the examination of microbes by light, phase contrast, dark field, confocal, fluorescent and electron (transmission and scanning) microscopy; Micrometry and microdensitometry.

### **BIO 222 INTRODUCTION TO CELL BIOLOGY AND PHYSIOLOGY (3 UNITS)**

**UNIT I:** History and present trends in cell Theory and cell biology.

**UNIT II:** A brief study of the molecular basis of cell structure and development. Organelles. Proteins and nucleic acids. Reproduction, cell division, cell differentiation and growth of cells.

**UNIT III:** Basis of biochemical processes in plants and animal cells; respiration, photosynthesis, transportation or circulation, reproduction, germination, nervous communication, growth hormones and enzymology.

### **BIO 272 GENERAL TECHNIQUES IN BIOLOGY (2 Units)**

Preparation of microscope slides, biological drawings, microtomy, colorimetry, photometry, cytological techniques, chromatography, collection and preservation of biological specimens. Herbarium Techniques, experimental design

### **STA 212 STATISTICS FOR BIOLOGICAL SCIENCES (4 UNITS)**

**Unit I:** Principles of measurements. Sampling techniques. Presentation of data in descriptive statistics. Frequency distribution. Measures of central tendency: mean, median and mode. Measures of dispersion: Mean deviation and standard deviation. Correlation and regression: Scatter Diagram, Coefficient of Correlation, Rank correlation. Lines of Regression.

**Unit II:** Probability: Basic concepts related to probability theory, classical probability. Probability Distributions: Introduction and simple properties of Binomial, Poisson and Normal Distributions and their applications in biology.

**Unit III:** Testing of hypotheses: Some basic concepts, Errors in hypothesis testing; critical region, Students t-test for the significance of population mean and the difference between two population means; Paired t-test; Chi square test for population variance, goodness of fit and for the independence of two attributes in a contingency table; F-test for the equality of two population variance; Analysis of variance- One-way and two-way analysis of variance.

## **300 LEVEL COURSES**

### **MCB 361 MICROBIAL GENETICS AND MOLECULAR BIOLOGY (3 UNITS)**

**Unit I:** Nucleic acids as genetic information carriers: experimental evidence. DNA structure: historical aspects & current concepts, melting of DNA, types of DNA. DNA replication in prokaryotes: types of polymerases, steps: initiation, elongation and termination.

**Unit II:** Fine structure of a gene in prokaryote; the rII locus, complementation test, recombination mapping, deletion mapping, cistron, recon, muton.

**Unit III:** Structural features of RNA (mRNA, tRNA, rRNA). Transcription in prokaryotes: RNA polymerase, promoter, steps: initiation, elongation & termination, antitermination. Inhibitors of RNA synthesis. Post transcriptional modification of mRNA: capping, polyadenylation & splicing (group I introns, group II introns, hn RNA using spliceosome/snurposome). Ribozymes. Regulation of gene expression : operon concept, negative & positive regulation, instability of bacterial mRNA, inducers and corepressors, catabolite repression. Negative regulation-E. coli. lac operon; positive regulation- E. coli. ara operon; regulation by attenuation- his and trp operons.

**Unit IV:** Mutation: spontaneous mutation, Induced mutagenesis- mutagens (physical mutagens: non ionizing radiation; chemical mutagens: Base analogues

, alkylating agents, deaminating agents, intercalating agents & others), molecular mechanism of mutagens. Detection & isolation of mutants. DNA repair mechanism: repair by direct reversal, excision repair, recombinational repair & SOS repair.

**Unit V:** Recombination: general principles. Plasmids (types of plasmids- F plasmids, R plasmids, Col plasmids & Ti plasmid ). Gene transfer mechanisms: transformation, transduction, conjugation. Mapping and sequencing the genome.

**Unit VI:** Transposable element: mechanism of transposition. Recombination & genome Mapping in viruses.

**Unit VII:** Microbial genetic & design of vaccines, BCG and design of vaccine for TB & leprosy. DNA vaccines design & advantages.

**Unit VIII:** Protein synthesis in prokaryotes. Basic features of the genetic code. Steps-details of initiation, elongation & termination, roles of various factors in the above steps, inhibitors of protein synthesis. Post translational modification of proteins.

### **MCB 311 FOOD AND DAIRY MICROBIOLOGY (2 UNITS)**

**Unit I:** Microbiology of primary food and food products: Animal and animal products (meat, milk and fish); Plants and plants products (cereals, fruits and vegetables). Important microbes involved in spoilage of food, meat, poultry, vegetables and dairy products; food preservation.

**Unit II:** Toxins : Bacterial and mycotoxins, Important microbes secreting toxins, chemical nature of important toxins; their role in food poisoning; physiology and mechanism of action, modification and detoxification; prevention and control of toxin contamination.

**Unit III:** Microbial biomass and Single cell proteins; Uses of microbes in meats and poultry products, vegetables *etc.* Use of microbial enzymes in food; low calorie sweeteners, Flavour modifiers; Food additives; Food quality monitoring, biosensors and immuno assays. Indian fermented foods.

**Unit IV:** Role of microbes in milk and dairy products: Microbiological examination of milk, standard plate count, direct microscopic count and reductase test, composition of milk, sources of contamination of milk, types of microbes in milk, pasteurization of milk, ability of milk to cause disease; Manufacture of cheeses, butter, yoghurt and fermented milk.

### **MCB321 ENVIRONMENTAL & AQUATIC MICROBIOLOGY (3 UNITS)**

**Unit I:** Microbes in extreme environments: Environment induced genetic and physiological adaptations in microbes; Characteristic features of thermophiles, psychrophiles, methanogens, methylotrophs, acidophiles, alkalophiles, halophiles.

**Unit II:** (a) Bioremediation: Microbial degradation of pesticides; hydrocarbons; clean up of sites polluted with oil spills, heavy metals and chlorinated solvents;

biological treatment of effluents of sugar, pulp and paper industry. (b) Recovery of minerals and metals from ores.

**Unit III:** Techniques in environmental microbiology: Methods for determination of numbers, biomass and activities of microbes in soil, water, air and on plant surfaces and dead organic materials. Brief account of air borne diseases of microbes and their preventive measures

**Unit IV:** Microbes in waste disposal: Microbes in solid waste and sewage treatment systems. Disinfection of potable water supplies. Bacteria indicators of water safety; Microbial assessment of water quality; Standards for tolerable levels of fecal contamination. Major waterborne diseases and their control measures.

### **MCB 301 MICROBIAL PHYSIOLOGY AND METABOLISM (3 UNITS)**

**Unit I:** (a) Nutritional requirements of major groups of microbes (bacteria & fungi); Nutritional uptake; transport across the membranes and cell wall (diffusion, passive diffusion, active transport, group translocation and iron uptake) (b) Physiology of growth and kinetics, Growth curve, generation time, growth kinetics measurement of growth (biomass, turbidity, dry weight, protein content), environmental factors affecting microbial growth.

**Unit II:** Nitrogen fixation in symbiotic and free living system, oxygen and hydrogen regulation of nitrogen fixation, nitrification, denitrification and ammonifying bacteria, Pathway of nitrate assimilation in photosynthetic and non-photosynthetic systems, transamination and deamination reactions.

**Unit III:** Photosynthesis: Absorption of light, photosynthetic and accessory pigments, (chlorophyll, bacteriochlorophyll, carotenoides, phycobilliproteins), Oxygenic and non-oxygenic photosynthesis in prokaryotes, non cyclic electron transport; phosphorylation; Calvin cycle; effect of light, temperature pH and CO<sub>2</sub> on photosynthesis; Photosynthetic yield and Photorespiration.

**Unit IV:** Respiratory metabolism: Glycolytic pathway of carbohydrates breakdown, Embden Meyer hoff pathway, Krebs's cycle and Entner-Duodoroff pathway, Phospho-ketolase pathway; Pentose phosphate pathway; oxidative and substrate level phosphorylation, gluconeogenesis, glyoxylate cycle, fermentation of carbohydrates, homo and heterolactic fermentation.

**Unit V:** Microbial metabolism: Anabolism, catabolism; Sulphur metabolism, Biosynthesis of purines and pyrimidines.

### **MCB 331 SOIL AND AGRICULTURAL MICROBIOLOGY (3 UNITS)**

**Unit I:** Characteristic of soil environments. Textural triangle. Microbial flora and fauna and their activities in the soil. Soil as a habitat for microorganisms; Soil enzymes, Soil water & microbial activity, Soil microorganism & nutrient cycle.

**Unit II:** Soil fertility and management of agricultural soils. Microbiology of composting and green manuring; reclamation of barren lands using microbial

technology. Microbiology of plant surfaces: Rhizosphere, phylloplane and rhizoplane microbes & their interaction with plants. Ecological relationship among the soil pathogens. Effects of pesticides on soil microorganisms. Biodegradation and biofuels generations. Soil survey techniques. Biogeochemical cycles including nitrogen fixation with emphasis on roles played by various microbes.

**Unit III:** Microorganisms as biofertilizers : Biofertilizers and symbiotic associations : Rhizobium - taxonomy, physiology, host-*Rhizobium* interaction, mass cultivation; Associative and non symbiotic association-*Azospirillum* , *Azotobacter*, Cyanobacteria Mycorrhiza and actinorrhiza in plant nutrition and stress tolerance; Interaction of mycorrhiza with *Rhizobium* and *Pseudomonas*; Commercial production of biofertilizers; Their applications and limitations for Indian agriculture.

**Unit IV:** Microorganisms as biopesticides: Microbiology of plant surfaces; Principles and mechanism of biological control; biocontrol agents for insect pest and weed control. Commercial production of biopesticides with reference to *Bacillus thuringiensis*; integrated pest management; Their applications and limitations for Indian agriculture.

### **MCB 323 BIODETERIORATION (2 UNITS)**

**Unit I:** Principles of microbial deterioration of materials. Materials subject to microbial deterioration.

**Unit II:** Major microbial groups involved in deterioration. Impact of processing and new technologies on biodeterioration.

**Unit III:** Biodegradation and Biogeochemical cycling: Microbial degradation of lignocellulosic substances, keratin and chitin; Microbes in nutrient cycling with special reference to carbon, phosphorous, sulfur and nitrogen cycles.

**Unit IV:** Microbial deterioration of food (cereals, pulses, fish and sea-foods) during storage. Deterioration of paper, fuel, leather, textile, wood, paint and metal corrosion. Biodeterioration of properties of cultural heritage/ methods for their protection.

### **MCB 303 BACTERIAL DIVERSITY (3 UNITS)**

**UNIT I:** Prokaryotic structure and function. Bacterial growth and nutrition. Classification, isolation and identification of bacteria, from air, water, soil, sewage, and other sources. Characteristics of principal groups of bacteria. Host-parasite relationship.

**UNIT II:** Pathogenic bacteria and disease. Virulence, spectrum and symptoms of infection, treatment and control. Kochs postulates. Methods of isolation of pathogens, bacterial infections and disposition of pathogenic culture. Structure, reproduction and classification of pathogenic bacteria. Biochemical characterization. Diagnosis (laboratory) and pathogenesis of actinomycoses and chlamydia infections.

**Unit IV:** Specimens: collection, handling, transport. Prevention & control of laboratory acquired infections. Identification of microorganisms: Different staining techniques (simple, Gram's staining, Ziehl-Neelsen method for AFB, Flurochrome staining, Leishman's staining, Geimsa's staining & special staining methods to demonstrate granules, capsules & spores). Growth & biochemical characteristic. Investigation of food borne & water borne disease outbreaks.

**Unit V:** Rapid methods of identification: immunologic techniques, bacteriophage typing & molecular methods (Nucleic acid-based detection methods, GLC, plasmid fingerprinting. Antimicrobial susceptibility testing: Diffusion methods & dilution methods), prophylactic immunization. Nosocomial infections.

### **BCH 322 ENZYMOLOGY (2 CREDITS)**

Classification and nomenclature of enzymes, Kinetic of enzymes and inhibition. Mechanism of enzyme-catalyzed reactions. Michael's Menten equation. Allosteric/regulatory enzymes. Estimation of kinetic parameters-enzymes Activities, Km, Vmax, Ki, Zymogen activator, digestive enzymes.: Enzyme production, immobilized enzymes and application, vitamins and coenzymes

### **MCB 312 INDUSTRIAL TRAINING (SIWES) (15 UNITS)**

This is known as students Industrial Work Experience Scheme (SIWES). Students will be posted to industrial establishments such as food processing, brewing, distillery, pharmaceutical, research institutes or medical and health institutions. This attachment covers a period of 6 months. During the training students will report their daily activities in a Log book. On return to school students will write a detailed and complete report of their activities. Each student shall be examined orally by a panel of Lecturers

## **400 LEVEL COURSES**

### **MCB 481 SEMINAR IN MICROBIOLOGY (2 UNITS)**

Under the supervision of a staff, students are expected to select a seminar topic for detail study, using library methods. Emphasis are laid on recent advances in the chosen field. The course is expected to give the student the opportunity for independent thoughts and expressions. The study will results in seminars and symposia.

### **MCB 451 PHARMACEUTICAL MICROBIOLOGY (3 UNITS)**

**Unit I:** Survey of commonly used antimicrobials. Biology/ecology of antibiotics producing microorganisms. Concepts of growth and death in microorganisms. Spectrum/ action of antimicrobial drugs.

**Unit II:** Microbial strains improvements for antibiotics producing microbes. Concepts of bacterial susceptibility to antibiotics in relation to bacterial, viral and fungal (microbial) physiology.

**Unit III:** Biological assay and mode of action of antimicrobial agents (susceptibility testing). Structure and composition of antibiotics and synthetic chemotherapeutic agents.

**Unit IV:** Production and quality control of antibiotics and antimicrobial agents. Hazards analysis and critical control points (HACCP) in production of antibiotics and pharmaceutical products.

### **MCB 443 PRINCIPLES OF EPIDEMIOLOGY AND PUBLIC HEALTH MICROBIOLOGY (3 UNITS)**

**Unit I:** Statistical applications to epidemiology. Nature of epidemiological investigations. Spectrum of infections.

**Unit I:** Innate immunity and line of infections. Herd immunity latency of infections. Epidemiological studies of systemic infections.

**Unit II:** Sewage and spread of infections. Zoonotic bacterial, fungal and viral infections and epidemiology. Multi factorial systems of epidemics.

**Unit III:** Antigenic drifts. Biological products for immunization. Types of vaccines Recommended immunization schedules. International control of infectious diseases. Challenges associated with immunization in Nigeria.

### **MCB 421 MICROBIAL ECOLOGY (2 UNITS)**

**Unit I:** Microbes and ecological theory. Physiological, morphological and genetic adaptations of microorganisms to their environment. Microbial interactions. Microorganisms in ecosystems.

**Unit II:** Microbial bio-conversions. Cycling of matters and microbial habitats. Risks posed by bioleaching. Physiology and genetics of *Thiobacillus ferrobacillus* and *Desulfovibrio* species.

**Unit III:** Environmental aspects of oil shale oxidation including industrial waste disposal. Management of industrial waste.

**Unit IV:** Ecological factors in Biotransformation, bio-illumination, biomining, bioleaching and biofertilization.

### **MCB 441 VIROLOGY (3 UNITS)**

**Unit I:** History of discovery of viruses; nature of viruses; General characters of viruses; Morphology; capsid and their arrangement; Nomenclature and classification of viruses; Cultivation of viruses: Animal inoculation, Embryonated eggs, Cell culture.

**Unit II:** General characters and ultra-structure of major plant viruses : Tobamovirus group (TMV); Tymovirus group (Circular mosaic virus); Tomato spotted wilt virus; Cauliflower mosaic virus. Effects of these viruses on plants

and various histological and physiological changes induced due to viral infection.

**Unit III:** General characters and ultrastructure of major human and animal viruses : Adenovirus, Poxvirus (DNA containing), Picornavirus, Retrovirus (RNA containing).

**Unit IV:** Structure, properties and classification of viruses. Principles of isolation, cultivation and maintenance of plant and animal cells *in vivo*. Application of cell culture technique in virology. Viruses as agents of diseases in animals.

**Unit V: (a)** General characters and structure of viroids, their common plant diseases and control; General characters of Prions, their structure and major diseases caused by them; controversies about their nature.

**(b)** Purification and quantitative assay of viruses; Infection and replication; Transmission and control of various plant and animal viruses.

### MCB 461 IMMUNOLOGY AND IMMUNOCHEMISTRY (3 UNITS)

**Unit I:** Introduction to the immune system: Innate immunity; anatomic, physiological, phagocytic & inflammatory barriers. Adaptive immunity; natural & artificial immunity. Cells involved in immune response: lymphoid lineage (producing B & T lymphocytes) & myeloid lineage (phagocytes: macrophages, neutrophils & eosinophils, auxillary cells; basophils, mast cells & platelets).

**Unit II:** Organs involved in immune system: primary & secondary lymphoid organs. Antigens: preparation of antigens, types of antigens- haptens, super antigens & clusters of differentiation molecules (CDs). Immunization of test animals, hyperimmunization.

**Unit III:** Immunoglobulins: structure & types of immunoglobulins, genetic diversity of immunoglobulins, catalytic antibodies. Cytokines: interferons ( $\alpha$ ,  $\beta$  &  $\gamma$ ), TNF, interleukins (1-16), hematopoietins & chemokines. B-cell biology & T-cell biology (major histocompatibility complex (MHC) molecules). Vaccines and Immunization; Types of Vaccines and their characteristics. Immune disorders ; hypersensitivities , autoimmune diseases ,transplantation(tissue ) Rejection , Immunodeficiencies .

**Unit IV:** Monoclonal antibodies: hybridoma technology, applications of monoclonal antibodies. Antigen-Antibody reactions in vitro: agglutination reactions (Widal, Haemagglutination), precipitation reactions (Immunodiffusion, Immuno electrophoretic method), Immunoblotting, ELISA, RIA, fluorescence immunosorbent assay, immunoelectronmicroscopy.

### MCB 471 RESEARCH METHODOLOGY (2 UNITS)

**Unit I:** Types of research, forms of medical research; Sampling techniques: randomization, simple random sampling, systematic, stratified and cluster sampling, multi stage sampling, quota sampling,

**Unit II:** Sources of research data: types of survey, survey design, interviewing methods, questionnaire design; Data processing, Study design and statistical test, **Unit III:** Writing research project, dissertation and thesis, Preparing for research proposal.

**Unit IV:** Referencing of research work. American Psychological Association style, Chicago style, Modern letters association, Council of Biological Editors and the Numeric system

### **ZOO 411 PRINCIPLES OF PARASITOLOGY ( 3 UNITS)**

**Unit I:** The ecological basis, nature origin and features of parasitism. Kinds and habitats of parasites. Concept and definition of hosts. Ecology and geographical distribution of human parasites.

**Unit II: Intestinal protozoa:** *Entamoeba histolytica*, *Balantidium coli*, *Trichomonas vaginalis*, *Giardia lamblia*: pathogenesis, life cycles, treatment, prevention and control. **Blood protozoa:** *Leishmania*, *Trypanosoma*, *Plasmodium* and *Toxoplasma*; pathogenesis, life cycles, treatment, prevention and control.

**Unit III: Trematodes: Fasciola and Heterophus heterophus;** Liver, intestinal flukes: etiology, pathogenesis, life cycles, treatment, prevention and control

**Blood flukes:** Schistosomiasis; etiology, pathogenesis, life cycles, treatment, prevention and control & Snails. **Cestodes:** etiology, pathogenesis, life cycles, treatment, prevention and control

**Unit IV: Intestinal nematodes I:** etiology, pathogenesis, life cycles, treatment, prevention and control Tissues nematodes: etiology, pathogenesis, life cycles, treatment, prevention and control. **Intestinal nematodes II:** etiology, pathogenesis, life cycles, treatment, prevention and control. **Tissues nematodes:** etiology, pathogenesis, life cycles, treatment, prevention and control.

**Unit V: Intestinal nematodes III:** etiology, pathogenesis, life cycles, treatment, prevention and control. Tissues nematodes: etiology, pathogenesis, life cycles, treatment, prevention and control. Introduction to Arthropods, Diptera & Hemiptera

### **MCB 412 ANALYTICAL MICROBIOLOGY AND QUALITY CONTROL (2 UNITS)**

Microorganisms as reagents in quantitative analysis. Selection of test organisms for assays (antibiotics, amino acids, vitamins, etc.). Responses of microorganisms used in assays. Obtaining and measuring responses. Preparation of assay samples. Methods of assays. Interpretation of results. Aspects of quality control. Plants and equipment sanitation. Microbiological standards and specifications.

### **MCB 414 INDUSTRIAL MICROBIOLOGY (3 UNITS)**

**Unit I:** Sources and characters of industrially potent microbes, their isolation, purification & maintenance. Screening of useful strains: primary screening &

secondary screening. Strain improvement through random mutation (random & rational selection), genetic recombination & genetic engineering. Microbial growth kinetics in batch, continuous & fed-batch fermentation process.

**Unit II:** Aerobic bioreactor: principles & designing. Other types of bioreactors. Raw materials used in fermentation media. Solid state fermentation & submerged fermentation: their advantages & disadvantages. Microbial transformations with special reference to steroids & alkaloids. Primary & secondary metabolites. Commercial production of antibiotics with special reference to penicillin, streptomycin and their derivatives.

**Unit III:** Microbiology & production of alcoholic beverages: malt beverages, distilled beverages, wine & champagne. Commercial production of organic acids like acetic, lactic, citric, & gluconic acids. Commercial production of important amino acids (glutamic acid, lysine & tryptophan), insulin & vitamins (vitamin B12, riboflavin & vitamin A).

**Unit IV:** Immobilization of microbial enzymes and whole cells and their applications in industries. Bioprocess Engineering: Downstream processing, various steps for large scale protein purification.

**Unit V:** Industrial enzymes production: Cellulases, Xylanases, Pectinases, Amylases, Lipases & Proteases and their applications. Bioconversion of waste for fuels (ethanol and methane). Mushroom cultivation. Petroleum microbiology. Patent protection for biological inventions.

### **MCB 416 ADVANCED FOOD AND FEED MICROBIOLOGY (3 Units)**

**Unit 1:** Advanced ecology, taxonomy, biochemistry and analytical technology of bacteria, yeasts, fungi and viruses associated with food spoilage, food-borne diseases and fermentations.

**Unit II:** *Emphasis on new developments in Food Microbiology;* Basic concepts of fermentation, alcohol fermentation resulting in production of bread, beer wine and vinegar acid, fermentation leading to production of cheese, butter, yoghurt, etc, malolactic fermentation

**Unit III:** Economic consequences of microorganisms in food; Microbial Diseases of farm animals; their prevention and control. Improvement of nutritive value of cattle feed using microbial activities. (b) Management & storage of agricultural products, post-harvest diseases, their prevention and control.

**Unit IV:** (a) Disease forecasting and basic principles of plant disease control. (b) Pathology, etiology and control of economically important crop diseases of wheat, rice, barley, maize, sugarcane, vegetables and pulses caused by fungi, bacteria and viruses

**Unit V:** Exploitation of microorganisms in novel processes for the production of food ingredients. Feed for cattle, use of microbes and microbial enzymes in the improvement of nutritive quality of feed; leaf protein extract. Microbiological examination of food

**MCB 422      PETROLEUM MICROBIOLOGY      (3 Units)**

**Unit I:** The origin of petroleum and gas, oxidation processes involved oil degradation, microorganisms employed in the hydrocarbon processes, corrosion of aluminum jets, fuel tank, etc. the effect of petroleum on microorganisms, microbial activities on the oil recovery processes.

**Unit II:** Factors affecting microorganisms in liquid hydrocarbons. Interactions between microorganisms and oil, microbes in prospecting for oil. The role and processing of single-cell protein (SCP), their usefulness and others.

**Unit III:** Detailed study of the carbon cycle. Theories about the genesis of fossil fuels with emphasis on microbiological influence. Prospecting for oil by means of microbial indicators. Drilling: Corrosion of pipes and equipment microbiology of the process. Acid mine drainage. Risks posed by bioleaching, physiology and genetics of *Thiobacillus ferrobacillus* and *Desulfovibrio* species.

**Unit IV:** Environmental aspects of oil shale oxidation including industrial waste disposal. Effects of oil spills on microbial ecology of seas and soils. Problem In transportation and storage microbial decomposition of petroleum economic considerations and control methods.

**Unit V:** Structure and recalcitrance of by-products of the petroleum industry including plastics, waxes, sprays, paints and oils. Fungal influence on these products.

**Unit I:** Equipment and models of experimentation in petroleum microbiology research. Relationships with other fields of petroleum technology

**MCB 442      PATHOGENIC MICROBIOLOGY II (3 UNITS)**

Study of some microbial pathogens of plants and animals with emphasis on those prevalent in Nigeria. The geographical distribution, isolation, identification, morphology, life cycle, source of infection, transmission and the host. Ecology, clinical manifestations of specific bacterial, viral and fungal pathogens of man.

**Unit I:** Specimens: collection, transport & storage. Prevention & control of laboratory acquired-infections. Investigation of food borne & water borne disease outbreaks. Manual & automated systems for microbial identification, immunoassays for the diagnosis of infectious diseases, molecular detection and identification of microorganisms. Different staining techniques.

**Unit II:** Rapid methods of identification: immunologic techniques, bacteriophage typing & molecular methods (Nucleic acid-based detection methods, GLC, plasmid fingerprinting).

**Unit III:** Bacteriology: Algorithm for identification of aerobic gram positive cocci and Gram positive rods, Gram negative rods. Algorithm for identification of aerobic gram negative rods, and anaerobic bacteria algorithm for identification of anaerobic bacteria; *Clostridium*.

**Unit IV :** Virology: algorithms for detection and identification of viruses; HIV; human T cell lymphotropic virus; Hepatitis A, B,C ,D and G viruses;

polyoma viruses; rabies virus; Epstein barr virus; Varicella zoster virus; human cytomegalovirus and respiratory syncytial virus .

**Unit V:** Basic and principles of taxonomy of pathogenic fungi, yeast and dermatophytes. Review of important mycoses, pathogenesis, epidemiology and transmission. Host response to fungal diseases. Recent developments in diagnostic medical mycology including exo-antigens, immunological techniques and DNA probes.

**Unit VI:** Molecular techniques and other typing methods. Recent advances in chemotherapy of mycotic infections. Fungal infections associated with Acquired Immune Deficiency Syndrome

Mycology: Algorithms for detection and identification of fungi; *Candida*, *Cryptococcus*; *Pneumocystis*; *Aspergillus*, *Fusarium* & Other opportunistic fungi; *Rhizopus*, *Rhizomucor*, *Absidia* & Other agents of systemic & subcutaneous zygomycoses; *Histoplasma*, *Blastomyces*, *Coccidioides*, & Other dimorphic fungi causing systemic mycoses.

**Unit VI:** Antimicrobial agents and susceptibility testing: Antibacterial agents, Mechanism of resistance to antimicrobial agents. Antimicrobacterial agents and susceptibility test. Antiviral agents and susceptibility test. Antifungal agents and susceptibility test

### **MCB 492 RESEARCH PROJECT IN MICROBIOLOGY (6 UNITS)**

A student will be expected to carry out a detailed research investigation under supervision of a staff in any special area of microbiology and biotechnology, write it up as a project report and be examined for his/her knowledge of the work before a panel of external and internal examiners in an oral examination.

